Temperature-Based Touchless Attendance System Using NodeMCU

Project Report

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Introduction

Traditional attendance systems typically rely on manual entry or contact-based scanning, which can increase the risk of infection transmission and are often inefficient in terms of data handling. To overcome these limitations, a Temperature-Based Touchless Attendance System is proposed.

This system integrates IoT (Internet of Things) and embedded technologies to enable contactless attendance recording and health screening. It uses an RFID module for user identification and an infrared temperature sensor (MLX90614) for non-contact temperature measurement. The NodeMCU microcontroller manages data acquisition, processing, and communication with the ThingSpeak cloud platform, where attendance and health data are stored and visualized in real time.

By automating both attendance and temperature screening, the system ensures a safe, efficient, and hygienic solution, particularly suited for schools, offices, and workplaces where minimizing contact is essential.

Objectives

1. To develop a contactless attendance system utilizing RFID technology and infrared temperature sensing for enhanced hygiene and efficiency.
2. To implement NodeMCU (ESP8266) as the core controller for sensor integration, data processing, and wireless connectivity.
3. To enable real-time data storage and visualization by uploading attendance and temperature records to the ThingSpeak cloud platform.

4. To incorporate an automatic health screening mechanism that verifies body temperature prior to recording attendance.

Block Diagram with Explanation

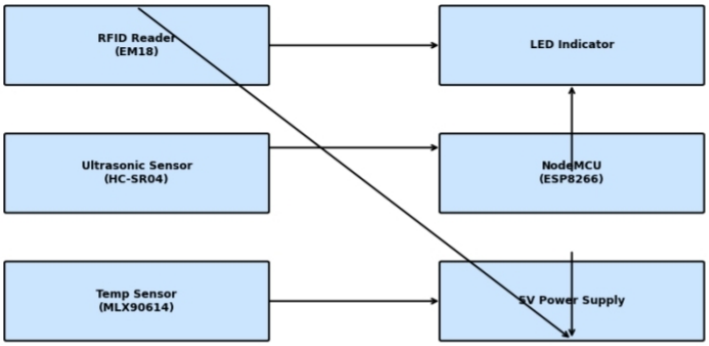

Figure 1: Functional Block Diagram of Temperature-Based Touchless Attendance System

Explanation: The block diagram of the system is composed of four primary modules — RFID Reader (RC522), Ultrasonic Sensor (HC-SR04), Infrared Temperature Sensor (MLX90614), and the NodeMCU (ESP8266) microcontroller. These components work in coordination to achieve fully automated, contactless attendance recording integrated with real-time temperature monitoring.

- **RFID Reader (RC522):** Responsible for reading RFID tags and identifying registered users uniquely and accurately.
- **Ultrasonic Sensor (HC-SR04):** Detects the presence of an individual and triggers the attendance process.
- **Infrared Temperature Sensor (MLX90614):** Measures the user's body temperature in a non-contact manner, ensuring hygiene and safety.
- **NodeMCU (ESP8266):** Serves as the central processing unit, coordinating sensor inputs, evaluating temperature thresholds, and transmitting data to the ThingSpeak cloud for visualization and storage.

When an individual approaches the system, the ultrasonic sensor first detects their presence and activates the RFID reader. The RFID module scans the user's tag to identify them, while the MLX90614 sensor simultaneously measures their body temperature. The NodeMCU then processes this information, determines the health status based on a predefined temperature threshold, and uploads the data — including user ID, temperature, and status — to ThingSpeak for real-time monitoring and record-keeping.

Circuit Diagram and Components

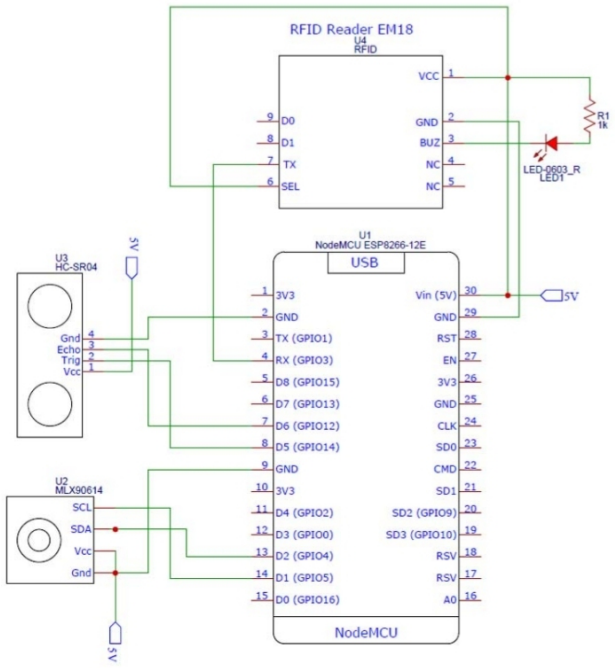

Figure 2: Circuit Diagram of the System

Components Used:

- NodeMCU (ESP8266-12E)
- RFID Reader (RC522)
- RFID Tags/Cards
- Ultrasonic Sensor (HC-SR04)
- Infrared Temperature Sensor (MLX90614)
- Jumper Wires and Breadboard

Working Principle:

1. System initializes sensors and connects to Wi-Fi.
2. Ultrasonic sensor detects presence.
3. RFID reader scans tag ID.
4. MLX90614 measures temperature.
5. NodeMCU evaluates and uploads data to ThingSpeak.
6. System resets for the next user.

Description of the Developed Code

Main Libraries Used

- `<ESP8266WiFi.h>` – Enables Wi-Fi connectivity.
- `<ThingSpeak.h>` – Uploads data to ThingSpeak.
- `<Adafruit_MLX90614.h>` – Reads data from MLX90614.
- `<MFRC522.h>` and `<SPI.h>` – For RFID tag reading.
- `<ESP8266HTTPClient.h>` – For HTTP communication (IFTTT integration).

Code Logic Overview

1. **Setup Phase:** Initialize sensors, Wi-Fi, and ThingSpeak.
2. **Loop Phase:**
    - Detect person using ultrasonic sensor.
    - Scan RFID tag.
    - Measure temperature using MLX90614.
    - Compare temperature with threshold (37.5°C).
    - Upload details to ThingSpeak or Google Sheets via IFTTT.

Image of the Working Model

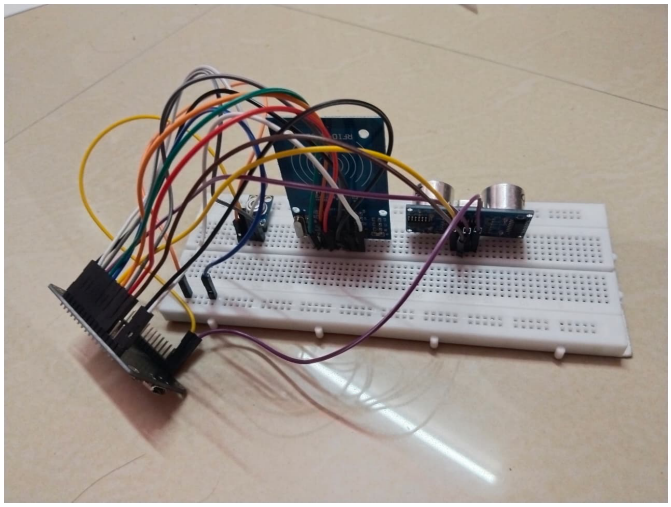

Figure 3: Image of the Working Model

Expected Outputs / Outcomes

The **Temperature-Based Touchless Attendance System** ensures a hygienic, automated, and real-time attendance mechanism.

1. Contactless temperature measurement.
2. Automatic attendance logging with timestamp.
3. Health classification:
    - Temperature < 37.5°C $\rightarrow$ Normal
    - Temperature ≥ 37.5°C $\rightarrow$ High Temperature
4. Real-time cloud visualization via ThingSpeak.
5. Auto data entry in Google Sheets using IFTTT.
6. LED indication for alerts.

Example Serial Monitor Output:

```
Connecting to WiFi...
WiFi Connected!
Person Detected!
RFID UID: 4A7B23C1
Temperature: 36.8°C
Status: Normal
Data Uploaded Successfully!
```

Overall, this IoT-based system delivers a reliable, real-time, and pandemic-safe attendance solution.